A preliminary survey of the freshwater mussels of the Welland River watershed in 2008

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ABSTRACT

Morris, T. J., McNichols-O'Rourke, K. A. and Robinson, A. 2012. A preliminary survey of the freshwater mussels of the Welland River watershed in 2008. Can. Manuscr. Rep. Fish. Aquat. Sci. 2991: iv + 11 p.

A survey of the freshwater mussels (Unionidae) of the Welland River was undertaken by Fisheries and Oceans Canada staff in August 2008. Eight sites were sampled throughout the watershed, with six from the main channel and two from tributaries (Oswego Creek and Lyons Creek). A total of 50 live animals were found, representing nine different species. *Quadrula quadrula*, which has been assessed as Threatened by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC) and designated Threatened under the Provincial *Endangered Species Act*, was the most abundant species. Although it only occurred at one site, it made up 50% of all animals found. *Pyganodon grandis* was observed at 75% of all sites, making it the most widely distributed species, despite representing only 28% abundance. This survey represents the most comprehensive and current survey of unionid fauna in the Welland River and as such lays the foundation for future studies in this watershed and in the Niagara Region.

RÉSUMÉ

Morris, T. J., McNichols-O'Rourke, K. A. and Robinson, A. 2012. A preliminary survey of the freshwater mussels of the Welland River watershed in 2008. Can. Manuscr. Rep. Fish. Aquat. Sci. 2991: iv + 11 p.

Une enquête portant sur les moules d'eau douce (famille des unionidés) de la rivière Welland a été entreprise par le personnel de Pêches et Océans Canada en août 2008. Huit sites ont été échantillonnés dans l'ensemble du bassin hydrographique, dont six du chenal principal et deux des affluents (Oswego Creek et Lyons Creek). En tout, 50 animaux vivants ont été découverts, et ils représentaient 9 espèces différentes. La moule *Quadrula quadrula*, qui a été qualifiée d'espèce menacée par le Comité sur la situation des espèces en péril au Canada et désignée en tant qu'espèce menacée en vertu de la *Loi sur les espèces en péril* de la province, était l'espèce la plus abondante. Même si sa présence n'a été constatée qu'à un site, cette moule représentait 50 % de l'ensemble des animaux découverts. La présence de la moule *Pyganodon grandis* a été constatée à 75 % des sites; par conséquent, cette espèce est la plus largement répandue, même si elle ne représente que 28 % de l'abondance. Cette enquête est la plus détaillée et la plus récente sur la faune des unionidés dans la rivière Welland et à ce titre, elle sert de fondement pour les études futures qui seront effectuées dans ce réseau hydrographique et dans la région de Niagara.

1.0 INTRODUCTION

The Welland River is located in the Niagara region of southern Ontario (Figure 1). The river is 142 km long, and drains an area of 880 km^2. It begins in Ancaster flowing east through the Niagara peninsula and drains into the largest tributary, the Niagara River (NPCA 2010). The watershed is located within the Haldimand clay plain, and is characterized by a low gradient, primarily a result of isostatic rebound from the most recent glacial retreat (NPCA 2010). The land use in the Welland River watershed is primarily agricultural, intermixed with some urban areas with Welland and Port Colbourne being the largest (NPCA 2010).

Historically, there were 28 species of mussels (Table 1) present within or just beyond the greater Niagara Peninsula Conservation Authority boundary. This is an area encompassing 2,424 km^2 – including the Welland River with species accounts dating back to 1885 (Lower Great Lakes Unionid Database 2011). Within the Welland River itself there have been a total of 11 species historically reported throughout the period from 1926 through 1988. No collections appear to have been made in the 20-year period between 1988 and the 2008 sampling.

Very limited information is available regarding these historic accounts and it is not clear whether they were collected as part of a formal mussel survey or simply the result of opportunistic collections. Despite the little information associated with the historical data, it does provide a record of species presence that can be used to compare with recent surveys. Records indicate that many endangered mussel species historically occurred in the Niagara Region and in the Welland River (Lower Great Lakes Unionid Database 2011; Table 1). Since there was some indication that significant species may currently inhabit the Welland River watershed, sampling was undertaken by Fisheries and Oceans Canada in 2008. The objective of the study was to determine the status of freshwater mussel populations in the Welland River watershed using the standard methodology established by Metcalfe-Smith et al. (2000).

2.0 METHODS

Eight sites in the Welland River watershed (Table 2, Figure 1) were visually surveyed using the suggested timed-search technique of Metcalfe-Smith et al. (2000) between August 19-26, 2008. At each site the substrate was surveyed to the maximum wading depth using visual (viewing boxes, naked eye) and tactile (excavation using hands and scoops) techniques. A team of at least three people moved parallel to the river bank for a total of 4.5 person-hours of searching per site. During the surveys all live animals were removed from the substrate and placed in a mesh diver's bag. At the end of the sampling period, mussels from all collectors were combined, identified, measured, sexed if possible, and returned to the river.

In addition to the biological data on the mussel community, several physical and environmental variables were also recorded at each site. These included substrate composition, water clarity, length of reach, mean stream depth, and width. Definitions of substrate sizes were modified from those of Wentworth (1922): boulder (>250 mm in

diameter), rubble (60-250 mm), gravel (20-50 mm), sand (<2 mm) and "other" material (mud, muck, silt, and detritus). Substrate composition and water clarity were visually estimated and the remaining variables were measured using a metre stick or measuring tape.

3.0 RESULTS

3.1 FRESHWATER MUSSEL COMMUNITY

A total of 50 animals representing nine live species were collected at six different sites during the Welland River watershed survey (Table 3, Figure 1). Total abundance varied from zero at two sites to 35 at one site. Species richness (total number of species observed) was low at all sites, again ranging from 0 when no mussels were found to a high of six species. The site with the highest abundance (WR-5) also had the highest species richness and was located mid-river in the main Welland River channel. A total of 25 *Quadrula quadrula* were found, making it the most abundant species (50% relative abundance), however, as it was observed at just one site, its frequency of occurrence remained low (12.5% of sites). *Pyganodon grandis*, was the second most common species (representing 28% of individuals) but was much more widely distributed, occurring at 75% of the sites (six out of eight). The invasive Zebra Mussel (*Dreissena polymorpha*) was observed at two of the sites (WR-7 and WR-8) in the Welland River near the Welland Canal (Table 3).

Given the relative paucity of animals it is not possible to evaluate the level of reproduction and recruitment occurring for most species. The exception being the Threatened *Q. quadrula* where nearly 1 in 6 animals were considered a juvenile or young adult, with a good range of sizes detected (Figure 2).

3.2 ABIOTIC FACTORS

Table 4 provides a summary of the physical data at each of the sites sampled in the Welland River watershed. Generally, the substrate was fine-textured, with at least 60% "other" material (muck, mud, silt, and detritus) observed at most sites. This was reflected in the water clarity, as poor visibility was reported at most sites. Site length and mean width ranged from 96 to 831 m and 4 to 75 m, respectively. Mean depth surveyed was approximately 1.1 m. The physical data collected were not meant to address issues relating to species microhabitat preferences, but rather to provide a general description of the site and assist future researchers in determining the exact location for further surveys.

4.0 DISCUSSION

According to COSEWIC (2006), *Q. quadrula* has been lost from approximately 49% of its former range in Ontario, most of this loss having occurred in the Great Lakes and their connecting channels. Threats include the presence of Dreissenid mussels

and habitat degradation associated with agricultural and urban activities. Historically, this species occurred in Lake Erie and Lake St. Clair, with additional locations in the Detroit, Sydenham, Grand, Welland, and Niagara rivers. There are four historical records of *Q. quadrula* shells in the Niagara Region, two of which were in the Welland River, in 1983 (Lower Great Lakes Unionid Database 2011). Prior to this survey, *Q. quadrula* was known alive from five watersheds: Ausable, Sydenham, Thames, Grand, and Bayfield rivers (COSEWIC 2006, Morris et al. 2012) making the Welland River a sixth. Since this is the first live occurrence of *Q. quadrula* in the Welland River it is not possible to determine abundance, or fluctuations and trends for this species in this system. However, the existence of a new and apparently reproducing population is a positive sign for the future of the species in Canada.

A lack of historical data makes it difficult to identify changes in species richness and abundance in the Welland River. However, two species collected during this work, the Lilliput (*Toxolasma parvum*), which is currently undergoing assessment by COSEWIC, and the Paper Pondshell (*Utterbackia imbecilis*), were found in the Welland River for the first time. They represent new species records for the Niagara region. Fresh shells of *Lasmigona costata* (Flutedshell) were also observed at one site in Oswego Creek, which is where one historical record indicated their presence. However, no live individuals have yet been observed (Lower Great Lakes Unionid Database 2011). Four species previously reported from the Welland River, including three Endangered species (*Ligumia nasuta, Obovaria subrotunda*, and *Ptychobranchus fasciolaris*) and one common species (*Elliptio dilatata*), were not found during the current survey efforts. This may indicate a shift in species composition (perhaps attributed to the presence of invasive species or habitat degradation), reflect the difficulty in locating imperiled species, or simply the result of low survey effort.

This sampling effort represents the most comprehensive survey of the unionid fauna in the Welland River watershed to date. The sampling was successful in confirming the existence of a population of *Q. quadrula*, which is a Species at Risk, however, questions remain regarding the status of others. Additional studies to determine the range of *Q. quadrula* within the Welland River and to fully asses its reproductive success within the watershed are needed. Additional intensive surveys are required to positively ascertain the status of the other federally listed species previously reported from the watershed but not detected during the 2008 sampling.

5.0 ACKNOWLEDGEMENTS

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Table 1. Mussel species occurring in the Niagara Region and in the Welland River (X = present, - = absent). Assessment by the Committee on the Status of Endangered Wildlife in Canada (COSEWIC). Designation (UC is "under consideration") under the federal *Species at Risk Act* (*SARA*) and the provincial *Endangered Species Act* (*ESA*). Unionid data from the Lower Great Lakes Unionid Database (2011).

Species		Niagara Region (1885 – 2002)	Welland River		COSEWIC (Assessment)[1]	*SARA* (Federal)[2]	*ESA* (Provincial)[3]
			1926 - 1988	2008			
Actinonaias ligamentina	Mucket*	X	-	-			
Alasmidonta marginata	Elktoe*	X					
Alasmidonta viridis	Slippershell Mussel	X	-	-			
Amblema plicata	Threeridge*	X					
Anodontoides ferussacianus	Cylindrical Floater	X	-	-			
Elliptio complanata	Eastern Elliptio	X	-	-			
Elliptio dilatata	Spike	X	X	-			
Epioblasma triquetra	**Snuffbox**	**X**	**-**	**-**	**Endangered**	**Endangered**	**Endangered**
Fusconaia flava	Wabash Pigtoe	X	-	-			
Lampsilis cardium	Plain Pocketbook	X	-	-			
Lampsilis siliquoidea	Fatmucket	X	X	X			
Lasmigona compressa	Creek Heelsplitter*	X					
Lasmigona costata	Flutedshell	X	-	X			
Leptodea fragilis	Fragile Papershell	X	X	X			
Ligumia nasuta	**Eastern Pondmussel**	**X**	**X**	**-**	**Endangered**	**UC**	**Endangered**
Ligumia recta	Black Sandshell	X	-	-			
Obovaria olivaria	**Hickorynut**	**X**	**-**	**-**	**Endangered**	**UC**	**Endangered**
Obovaria subrotunda	**Round Hickorynut**	**X**	**X**	**-**	**Endangered**	**Endangered**	**Endangered**
Pleurobema sintoxia	**Round Pigtoe**	**X**	**-**	**-**	**Endangered**	**Endangered**	**Endangered**
Potamilus alatus	Pink Heelsplitter	X	X	X			
Ptychobranchus fasciolaris	**Kidneyshell**	**X**	**X**	**-**	**Endangered**	**Endangered**	**Endangered**
Pyganodon grandis	Giant Floater	X	X	X			
Quadrula pustulosa	Pimpleback*	X	-	-			
Quadrula quadrula	**Mapleleaf**	**X**	**X**	**X**	**Threatened**	**UC**	**Threatened**
Strophitus undulatus	Creeper	X	X	X			
Toxolasma parvum	Lilliput	-	-	X			
Truncilla donaciformis	**Fawnsfoot***	**X**			**Endangered**	**UC**	**Endangered**
Truncilla truncata	Deertoe	X	X	X			
Utterbackia imbecillus	Paper Pondshell	-	-	X			
Villosa iris	**Rainbow**	**X**	**-**	**-**	**Endangered**	**UC**	**Threatened**
Total		**28**	**11**	**10**			

* Just outside Niagara Region boundary, [1] COSEWIC (2011), [2] Species at Risk Public Registry (2011), [3] OMNR (2011)

Table 2. Site descriptors and collectors for all Welland River watershed sites surveyed in 2008 by Fisheries and Oceans Canada. All sites were surveyed for 4.5 person hours.

Site	Date	Latitude	Longitude	Waterbody	Watershed	Local Description	Collectors
WR-1	19/08/08	43.072603	-79.782849	Welland River	Welland River	Hall Rd off HWY 56	Marjerrison, Ashforth, Rosairus
WR-2	19/08/08	43.042983	-79.684566	Welland River	Welland River	Abungdon Rd bridge between north and south Chippewa	Marjerrison, Ashforth, Rosairus
WR-3	19/08/08	43.133299	-79.924592	Welland River	Welland River	off Hwy 6 at Chippewa Rd southwest of Hamilton	Marjerrison, Ashforth, Rosairus
WR-4	20/08/08	42.977612	-79.608809	Oswego Creek	Welland River	Hart Rd	Morris, Marjerrison, Ashforth, Rosairus
WR-5	20/08/08	43.020931	-79.617447	Welland River	Welland River	Church Rd south of Chippewa Rd	Morris, Marjerrison, Ashforth, Rosairus
WR-6	25/08/08	42.997732	-79.143338	Lyons Creek	Welland River	Crowland Rd	Marjerrison, Ashforth, Rosairus
WR-7	25/08/08	42.975834	-79.274154	Welland River	Welland River	Welland	Marjerrison, Ashforth, Rosairus
WR-8	26/08/08	43.004434	-79.479833	Welland River	Welland River	Chippewa Cr Conservation Area; between Canborough Rd and Creek Rd, west of Wellandport	Marjerrison, Ashforth, Rosairus

Table 3. Number of live specimens and fresh shells (SH) of each species collected at each of the eight sites surveyed in the Welland River watershed in 2008.

Common Name	Name	WR-1	WR-2	WR-3	WR-4	WR-5	WR-6	WR-7*	WR-8*	Total Abundance	Relative Abundance (%)	Frequency of Occurrence (%)
Three-ridge	*Amblema plicata*	-	-	-	-	-	-	-	-	0	0	0
Slippershell Mussel	*Alasmidonta viridis*	-	-	-	-	-	-	-	-	0	0	0
Cylindrical Papershell	*Anodontoides ferussacianus*	-	-	-	-	-	-	-	-	0	0	0
Plain Pocketbook	*Lampsilis cardium*	-	-	-	-	-	-	-	-	0	0	0
Fatmucket	*Lampsilis siliquoidea*	-	-	-	-	1	-	-	-	1	2	12.5
White Heelsplitter	*Lasmigona complanata*	-	-	-	-	-	-	-	-	0	0	0
Creek Heelsplitter	*Lasmigona compressa*	-	-	-	-	-	-	-	-	0	0	0
Flutedshell	*Lasmigona costata*	-	-	-	SH	-	-	-	-	0	0	0
Fragile Papershell	*Leptodea fragilis*	-	-	-	-	2	-	-	-	2	4	12.5
Pink Heelsplitter	*Potamilus alatus*	-	-	-	-	3	-	-	-	3	6	12.5
Giant Floater	*Pyganodon grandis*	1	-	-	4	2	5	1	1	14	28	75
Mapleleaf	*Quadrula quadrula*	-	-	-	-	25	-	-	-	25	50	12.5
Creeper	*Strophitus undulatus*	-	-	-	-	-	-	-	1	1	2	12.5
Lilliput	*Toxolasma parvus*	-	-	-	-	-	-	-	1	1	2	12.5
Deertoe	*Truncilla truncata*	-	-	-	-	2	-	-	-	2	4	12.5
Paper Pondshell	*Utterbackia imbecillus*		-	-	1	-	-	-	-	1	2	2
Rainbow	*Villosa iris*	-	-	-	-	-	-	-	-	0	0	0
	Count	1	0	0	5	35	5	1	3	50		
	Richness	1	0	0	2	6	1	1	3	9		

* Zebra Mussels present

Table 4. Physical characteristics of the sites surveyed in the Welland River watershed in 2008. Substrate types are modified from (Wentworth 1922): boulder is >250 mm in size, rubble is between 60-250 mm in size, gravel is between 20-50 mm in size, and sand is <20 mm in size. "Other" includes muck, mud, silt, and detritus.

Site	Substrate (%)					Water clarity	Site length (m)	Mean width (m)	Mean depth searched (m)	Stream morphology (%)			
	Boulder	Rubble	Gravel	Sand	Other					Riffle	Run	Pool	Flat
WR-1	5	10	10	0	75	murky	831	5	0.6	5	15	10	70
WR-2	0	20	15	0	60	murky	704	14	1	15	0	10	75
WR-3	0	5	5	0	90	murky	212	4	1.25	0	5	5	90
WR-4	0	0	0	5	95	murky	105	18	1.25	0	0	0	100
WR-5	0	10	10	10	70	murky	218	12	1	5	35	20	40
WR-6	5	0	0	10	85	good/murky	300	4	1.25	5	5	5	85
WR-7	0	0	5	15	80	murky	96	75	1	0	0	0	100
WR-8	0	0	0	10	90	murky	96	50	1.25	0	0	0	100

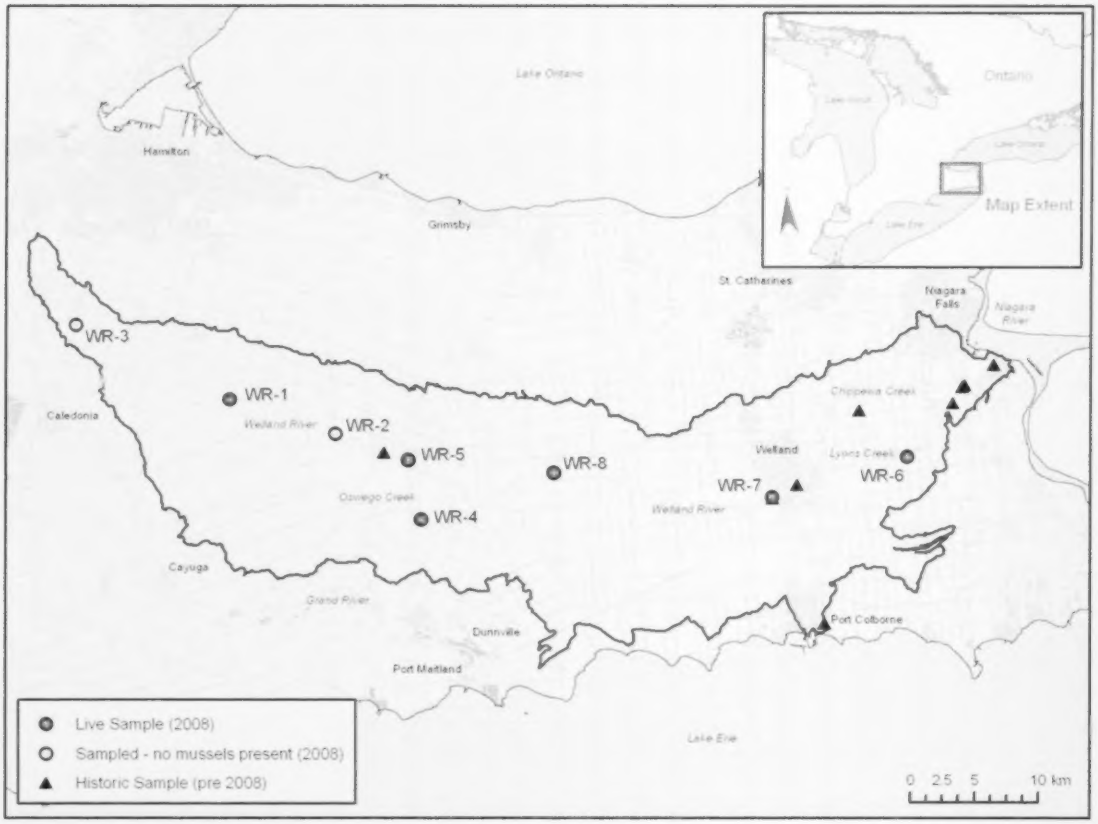

Figure 1. Historical and current sites surveyed in the Welland River Watershed. Current sampling events (labeled) occurred in 2008 by Fisheries and Oceans Canada.

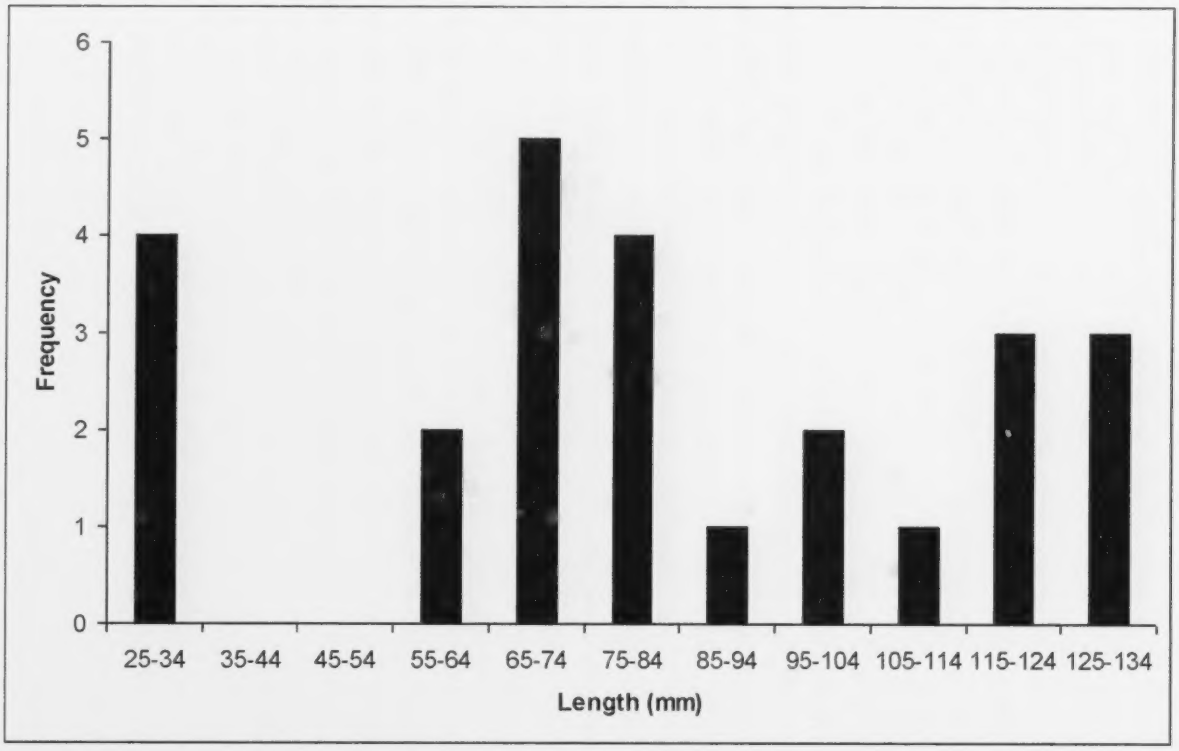

Figure 2. Length (mm) frequency distribution of *Quadrula quadrula* (Mapleleaf Mussel) observed in the Welland River during 2008 surveys (n = 25).